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Can Venezuelan scenario be repeated in Tunisia?

The role of remittances in an inflationary context

Refk SELMI¹ and Farid MAKHLOUF²

Abstract

Over the past decade, remittances to Tunisia have increased significantly. Meantime, the Tunisian economy has grown by as little as 0.6 percent on average with inflation averaging six percent. With the harmful economic and social consequences of the COVID-19 crisis as well as the political unrest (especially after Tunisian President Kais Saied invoked Article 80 of the country's 2014 constitution to suspend parliament amid nationwide protests calling for the resignation of the government and the dissolution of the parliament), managing inflation risks seems growingly challenging. Our study is the first attempt to examine the relationship between remittances and Tunisia's inflation dynamics in the central and tail distributions over different correlation regimes. Particularly, we use a copula-based approach that sheds a new light on the dynamic dependence between inflation and remittances. This technique allows to control for possible asymmetries in the form of a high or crisis dependence and a low or a normal state dependence. Our results robustly reveal that remittances are prominent factor determining inflation in Tunisia. More interestingly, we show that remittances and inflation are more strongly correlated during high uncertainty conditions rather than low uncertainty regime. Such accurate insights on the dynamic relationship between remittances and inflation would allow the central bank to anticipate more effectively the evolution of inflation and to propose more appropriate instruments to control it in a context of high inflationary pressures and heightened political uncertainty.

Keywords: Inflation; Remittances; Tunisia; Political instability; Copula-based approach.

JEL Codes: E31; F24.

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1. Introduction

Tunisia, like most developing countries, suffered from a relatively high inflation rate, a low growth rate, remittances dependence and continues to suffer as political instability keeps rising. According to the Central Bank of Tunisia (CBT), inflation continued its upward trend to reach a rate of 5.7% (year-on-year) in July 2018 against 5.6% in June 2018. As regards inflation in manufactured goods, in August 2017 recorded a rate of 7.4%. The Arab Spring came to worsen the situation (Edelbloude, et al., 2017). More particularly, the political upheavals have brought enormous changes and uncovered anxiety regarding the country's future. For instance, the unemployment rate was unchanged at 15.4% and even increases, which is the greatest joblessness figure in the Maghreb region. In addition, the construction and building materials sector collapsed by about 2.3% since few middle-class families bought homes mainly owing to inflationary pressures and wide costs for loans.

Tunisia plunged into an unprecedented economic crisis after the 2011. **The nine governments since 2011 have all failed to cut the budget deficit or control inflation.** Based on the latest CBT statistics, foreign exchange reserve declined to 4.35 billion U.S. dollars by 2019, the lowest level in 20 years. The country requires more than \$3 billion in foreign loans to keep the economy afloat. This has been worsened by the emergence of the coronavirus outbreak. With the heightened uncertainty surrounding the COVID-19 pandemic, the majority of economies worldwide have been affected adversely, and Tunisia is no exception. The projection for the inflation rate in 2020 was revised to 8%, under a worst-case scenario, where the COVID persists till now. Prior to the COVID-19 pandemic, the outlook was at 6.7 percent. For 2021, the projected inflation rate was reviewed to 7%, also while accounting for the worst-case

scenario. Previously, a 6.1 percent inflation rate was projected (see Figure A1 in Appendix).

After the 2011 uprisings, Tunisia was economically destabilized. Indeed, the tourism sector declined markedly, FDI collapsed, foreign trade decreased, and the dinar depreciated noticeably. However, remittances unusually survived and even raised (Makhlouf and Selmi, 2021; Edelbloude et al. 2017). While the remittances received were around \$0.5 billion in 1990, they reached \$1.9 billion in 2008, and continued to increase attaining \$2.73 billion in 2018. The marked increase of remittances in developing countries generally has yielded to huge debate and controversy among academics focusing on the economic implications of remittances flows for recipient countries (Adams and cuecuecha, 2010; Makhlouf and Kasmaoui, 2020). The major controversy revolves around whether remittances have a positive or negative effect on origin countries (Makhlouf, 2013). On this vein, the relationship between remittances and inflation has been debated (see inter alia, Narayan, 2011; Chnaina and Makhlouf, 2015; Makhlouf, 2019). For instance, Narayan et al. (2011) find evidence that in developing countries remittances generate inflation. As we have noted relatively high rate of inflation in Tunisia, this paper tries to detect the implications of remittances on the evolution of prices. It examines the effects of remittances on a small open economy that exports labor³ on inflation. Remittances can have a positive impact on the balance of payments. They can also have a positive effect on economic growth in countries of origin (Makhlouf, 2019). However, they can have inflationary effects and

³ Tunisia is a country of emigration, the main destination is Western Europe, but other destinations appeared more recently such as North America and the Gulf countries.

lead to an appreciation in the real exchange rate. That is why Grabel (2008) concludes that the macroeconomic effects of remittances are complex.

Although there is a significant strand of the literature on the economic impacts of remittances, there is much less evidence on the relationship between remittances and inflation. The present study contributes to the existing literature in at least two ways: Firstly, this study assesses the role of remittances in a spiraling inflationary framework in times of unprecedented political turmoil by delving into the case of Tunisia. Secondly, it is the first research, to our best knowledge, that conducts a large range of empirical methodologies to examine this debated topic. More specifically, we apply a large variety of copula models ranging from time-invariant copulas to time-varying and asymmetric copula-based approaches in an attempt to properly capture the non-normalities of marginal distributions on the one hand, and on the other hand, the asymmetry and the dynamic dependence structure. The existing literature suggests that a time-invariant copula is irrelevant since it does not allow the parameters in a copula function to change over time (for instance, Patton 2006; Harvey 2010). While the time-invariant copula model can only capture either a high (crisis) or a low (normal state) dependence regime, the copula model with dependence switching is flexible to switch between high and low correlation regimes. The use of various copula techniques ranging from the single copula model to time-varying copulas would allow us to robustly and properly analyze the relationship between remittances and inflation; and accordingly, to provide fresh insights on how efficaciously managing inflation risks in an uncertain context. By pursuing such an accurate assessment that controls for asymmetry and nonlinearity (i.e., a state-by-state correlation), one can improve the prediction of the inflation process, and this in turn would undoubtedly help monetary authorities to make the most appropriate decisions in the current times of

rising social, economic and political uncertainties. In short, the present study aims at elucidating the understanding of the remittances-inflation nexus -an issue that has been barely discussed- thereby enabling one to formulate relevant policies mitigating inflation risks.

Our findings indicate that increasing remittances induce inflationary pressures. Our results also reveal that this relationship seems more pronounced in times of rising uncertainty rather than in periods of low uncertainty. These findings are still fairly robust to changes in time periods and different copula families.

The remainder of the paper is organized as follows. Section 2 reviews the related literature on the impact of remittances on inflation. Section 3 describes the conducted methodology, the data and the descriptive statistics. Section 4 reports and discusses the main results. Section 5 provides some concluding remarks and relevant policy implications.

2. Related literature

The consequences of remittances are a major debate in the countries of origin (Makhlouf and Kasmaoui, 2020). This is because remittances are associated with several aspects: political, but also economic, social and societal (Makhlouf, 2013). In this section, we address the most important consequences of remittances on inflation. Nowadays, two adverse effects of remittances on the economies of countries of origin are analyzed by economists, namely the emergence of Dutch disease in countries of origin (Mughal and Makhlouf, 2013) and the decline in labor supply (Barham et Boucher, 1995; Funkhsouer 1992). Few studies are devoted to analyzing the effects of remittances on inflation. Kim (2007) shows that remittances increase the reservation

wage, so they can have an indirect effect on prices by increasing wages. They also influence fiscal policies (Ebeke, 2011) and also exert a significant impact on the government spending (Kapur and Singer, 2006), which in turn can affect inflation. From this viewpoint, Acosta (2006) shows that remittances improve the budget of recipient families and reduce their cash flow problems. Thus, they allow for more investment and consumption, which would increase overall demand and might exert pressure on prices. Remittances also have an effect on housing demands; for example, Miotti et al. (2010) show that Moroccan migrants invest more in their home countries than in their host countries, and most of their investments are in the real estate sector. Remittances can have an effect on prices through the business cycle. Remittances are broadly considered in the literature to be countercyclical (Makhlouf and Kasmaoui, 2020) which can mitigate inflation. The relationship between remittances and inflation is bi-causal: on the one hand, inflation may play a role in determining remittances (Elbadawi et Rocha, 1992; El-Sakka and McNabb, 1999; Makhlouf and Kasmaoui, 2017) and, on the other hand, remittances may have an effect on price changes (Makhlouf, 2013). In the case of Mexico, Vargas-Silva (2007) find that a positive shock of remittances has a positive impact of domestic money demand. In this vein, Makhlouf (2013) find the same result in the case of Morocco. Recently and by delving into the experiences of Bangladesh, India, Nepal, Pakistan and Sri Lanka, Basnet et al. (2021) deduce that the inflationary impact of remittances in South Asia evolves over different time scales. More specifically, remittances reduce inflation (negative effect) in the short-term while they rise it (positive effect) in the long-term.

Moreover, remittances to Tunisia are sensitive to political and economic shocks in Tunisia. For example, remittances increased significantly after the Arab Spring in Tunisia in late December 2010 (the impact of remittances on countries of origin is

multidimensional, see Makhoul, 2019). Remittances to Tunisia are sensitive to political and economic shocks in Tunisia. For example, remittances increased significantly after the Arab Spring in Tunisia in late December 2010 (Edelbloude et al. 2017).

Furthermore, Narayan et al. (2011) find that remittances generate inflation in the countries of origin, by using the Arellano and Bond panel dynamic estimator and the Arellano and Bover and the Blundell and Bond system generalized method of moments estimator. They claim also that democracy mitigates inflation. According to the Narayan et al. (2011), remittances can affect inflation through three channels: the money supply; the exchange rate; and the balance of payments. Khan and Islam (2013) find in the case of Bangladesh that a 1% increase of remittances increases inflation rate by 2.48%. For Pakistan, Nisar and Tufail (2013)'s findings reveal that remittances have a positive impact on inflation and its different categories, more precisely, food inflation is most effected and housing inflation is least affected. The effect of remittances on inflation may also depend on the exchange rate regime; Indeed, Ball et al. (2008) demonstrate that in the fixed exchange rate regime remittances appear to have a positive effect on inflation through money, whereas in a flexible exchange rate regime remittance have an opposite effect. For the case of Bangladesh, Roy and Rahman (2014) show that remittance inflows cause an inflationary pressure. By delving into the experience of Mexico, Balderas and Nath (2005) find that a positive relationship between inflation and relative price variability. They, also, show that remittances have a positive effect on inflation from 1994. In India, Adhikari and Guru-Gharana (2013) state that remittances do not have a significant effect on prices. Remittances can have inflationary effects and lead to an appreciation of the real exchange rate. In addition, Makhoul (2013) claim that remittances can also influence fluctuations in other macroeconomic variables in the home country such as

the exchange rate, money supply and interest rate. More recently, Callejas (2021) investigates the relationship between remittances and housing prices at the aggregate level and deduces that remittances seem to decrease housing prices. Besides, Dilanchiev et al. (2021), using quarterly data covering a period (2000-2018), in Georgia finds that in the long run remittances are positively associated with inflation. In this vein, Omotosho and Ogu (2021) investigate the impact of remittances on price stability in Nigeria from 1980 to 2019, and find that remittances increase the general price level in the long run. They also conclude that remittances affect price stability in Nigeria.

3. Empirical investigation

3.1. Methodology: Time invariant vs. time-varying Copula estimations

This study explores the dependence structure between the inflation changes (X_1) and remittances (X_2). For this purpose, the copula is employed to investigate the bivariate joint distribution function, $F_{X_1X_2}(x_1, x_2)$ for the two random variables. Based on Sklar's theorem (Sklar, 1959), the joint distribution of two random variables can be defined in terms of a copula after transforming marginal distributions into uniform distributions. The joint distribution of the two variables can be described through a copula function C denoted as:

$$F_{X_1X_2}(x_1, x_2) = C(u, v), \quad (1)$$

Where:

$$u = F_{X_1}(x_1) \text{ and } v = F_{X_2}(x_2).$$

The joint probability density of the variables X_1 and X_2 is then derived via the copula density, $(u, v) = \frac{\partial^2 C(u, v)}{\partial u \partial v}$, expressed as following:

$$f_{X_1X_2}(x_1, x_2) = c(u, v)f_{X_1}(x_1)f_{X_2}(x_2), \quad (2)$$

Where $f_{X_1}(x_1)$ and $f_{X_2}(x_2)$ are, respectively, the marginal densities of the random variables X_1 and X_2 .

Patton (2006) by extending the Skalar's theorem demonstrates the lower (left) and upper (right) tail dependence of two random variables for the copula to be as follows:

$$\tau^L = \lim_{u \rightarrow 0} \Pr (F_{X_1}(x_1) \leq u | F_{X_2}(x_1) \leq u) = \lim_{u \rightarrow 0} \frac{C(u,u)}{u} \quad (3)$$

$$\tau^U = \lim_{u \rightarrow 1} \Pr (F_{X_1}(x_1) > u | F_{X_2}(x_1) > u) = \lim_{u \rightarrow 1} \frac{1-2u-C(u,u)}{1-u}, \quad (4)$$

Where τ^L and $\tau^U \in [0,1]$.

This research applies **several copula functions with symmetric and asymmetric tail behavior, while controlling for time-varying dependence**. We first consider elliptical Gaussian and Student-t copulas which are usual choices for the market dependence structure. These functions are denoted as:

$$C^{Gaussian}(u_t, v_t; \rho) = \Phi(\Phi^{-1}(u_t), \Phi^{-1}(v_t)) \quad (5)$$

$$C^{Student-t}(u_t, v_t; r, \nu) = T_\nu(t_\nu^{-1}(u_t), t_\nu^{-1}(v_t)) \quad (6)$$

where Φ is the bivariate standard normal CDF with correlation ρ ($-1 < \rho < 1$), $\Phi^{-1}(u_t)$ and $\Phi^{-1}(v_t)$ are standard normal quantile functions, T is the bivariate Student-t CDF with the degree-of-freedom parameter ν and the correlation ρ ($-1 < \rho < 1$), and $t_\nu^{-1}(u_t)$ and $t_\nu^{-1}(v_t)$ are the quantile functions of the univariate Student-t distributions. Both copulas display symmetric dependence, even though the Gaussian has zero tail dependence and the Student-t displays tail dependence given by $\lambda_U = \lambda_L = 2t_{\nu+1}(-\sqrt{\nu+1}\sqrt{1-\rho} / \sqrt{1+\rho}) > 0$.

The study also accounts for copulas with symmetric tail dependence, namely, the Plackett and the Frank copulas, expressed, respectively, as:

$$C^{Plackett}(u_t, v_t; \pi) = \frac{1}{2(\pi-1)} (1 + (\pi-1)(u_t + v_t) - \sqrt{(1 + (\pi-1)(u_t + v_t))^2 - 4\pi(\pi-1)u_t v_t}) \quad (7)$$

$$C^{Frank}(u_t, v_t; \lambda) = \frac{-1}{\lambda} \log \left(\frac{(1 - e^{-\lambda}) - (1 - e^{-\lambda u_t})(1 - e^{-\lambda v_t})}{(1 - e^{-\lambda})} \right) \quad (8)$$

where $\pi \in [0, \infty) \setminus \{1\}$ and $\lambda \in (-\infty, \infty) \setminus \{0\}$. It must be pointed out at this stage that the two above copulas exhibit tail independence.

Given the fact that the dependence between the variables of interest may behave distinctly over different circumstances (a high (crisis) or a low (normal state) dependence regime), this study implements copula functions with asymmetric tail dependence structures. The Gumbel copula reflects upper tail dependence, while its rotation reflects lower tail dependence, expressed, respectively, as:

$$C^{Gumbel}(u_t, v_t; \delta) = \exp \left(- \left((-\log u_t)^\delta + (-\log v_t)^\delta \right)^{1/\delta} \right) \quad (9)$$

$$C^{Rotated_Gumbel}(u_t, v_t; \delta) = u_t + v_t - 1 + C^{Gumbel}(1 - u_t, 1 - v_t; \delta) \quad (10)$$

Where $\delta \in (1, \infty)$. The upper and lower tail dependence structures of the Gumbel copula are $\lambda_U = 2 - 2^{1/\delta}$ and $\lambda_L = 0$, respectively, while the opposite holds for the rotated Gumbel.

Moreover, we utilize the symmetrized Joe-Clayton (SJC) copula since it takes into account both lower and upper tail dependence, accounting for possible asymmetry.

$$C^{SJC}(u_t, v_t; \lambda_U^{SJC}, \lambda_L^{SJC}) = 0.5(C^{JC}(u_t, v_t; \lambda_U^{JC}, \lambda_L^{JC}) + C^{JC}(1 - u_t, 1 - v_t; \lambda_U^{JC}, \lambda_L^{JC}) + u_t + v_t - 1) \quad (11)$$

Where:

$$C^{JC}(u_t, v_t; \lambda_U^{JC}, \lambda_L^{JC}) = 1 - (1 - \{[1 - (1 - u_t)^\kappa]^{-\gamma} + [1 - (1 - v_t)^\kappa]^{-\gamma} - 1\}^{-1/\gamma})^{1/\kappa},$$

$$\kappa = 1/\log_2(2 - \lambda_U^{JC}) \text{ and } \gamma = -1/\log_2(\lambda_L^{JC}).$$

For this copula function, the tail dependence coefficients are themselves the parameters of the copula. So, if $\lambda_U^{SJC} = \lambda_L^{SJC}$, then the market structure is symmetric, otherwise it is asymmetric. Then, we account for possible time-varying dependence structure. For the Gaussian and Student-t copulas, we are able to describe the dynamics of the linear dependence parameter as evolving flexibly over time based on a new econometric tool proposed by Patton (2006), expressed as follows:

$$\rho_t = \Lambda \left(\Psi_0 + \Psi_1 \rho_{t-1} + \Psi_2 \frac{1}{10} \sum_{j=1}^{10} \Phi^{-1}(u_{t-j}) \cdot \Phi^{-1}(v_{t-j}) \right) \quad (12)$$

Where Λ denotes the logistic transformation $\Lambda(x) = (1 + e^{-x})^{-1}$ that is employed to keep ρ_t within $(-1, 1)$. For the Student-t copula, $\Phi^{-1}(x)$ is substituted by $t_{\nu}^{-1}(x)$. For the conditional Gumbel copula and its rotation, the evolution of δ is specified based on ARMA (1, 10) process that can be denoted as:

$$d_t = \Psi_0 + \Psi_1 d_{t-1} + \Psi_2 \frac{1}{10} \sum_{j=1}^{10} |u_{t-j} - v_{t-j}| \quad (13)$$

For the SJC copula, the variation of upper and lower tail dependencies over time can be given by an ARMA (1,10) process as follows:

$$\tau_{L,t}^{SJC} = \Lambda \left(\Psi_0^L + \Psi_1^L \tau_{L,t-1}^{SJC} + \Psi_2^L \frac{1}{10} \sum_{j=1}^{10} |u_{t-j} - v_{t-j}| \right);$$

$$\tau_{U,t}^{SJC} = \Lambda \left(\Psi_0^U + \Psi_1^U \tau_{U,t-1}^{SJC} + \Psi_2^U \frac{1}{10} \sum_{j=1}^{10} |u_{t-j} - v_{t-j}| \right) \quad (14)$$

3.2. Data and descriptive statistics

We use monthly data on remittances in millions of Tunisian Dinar and inflation (we consider the change in the consumer price index, base 2000). Table 1 displays descriptive statistics. Some interesting findings should be underscored. Over the period (2005-2020), Tunisia receives on average 1 billion remittances in local currency. In January 2020, remittances reached their highest value ever. This increase during the pandemic period corresponds to informal remittances passing through formal channels following the closure of the border. This hypothesis is verified in the case of Mexico by Dinarte et al (2021).

. **Table 1.** Summary descriptive statistics

Statistics	N	Mean	St.Dev.	Min	1st Qu.	3rd Qu.	Max
Remit	193	1,502.075	787.202	484.300	899.300	1,987.500	3,209.300
Inflation	193	0.004	0.003	-0.006	0.002	0.006	0.012

We can clearly note from Figure 1 the great volatile behavior of inflation over the period 2005-2020 depicted through the excessive ups and downs. We cannot have accurate information about the dependence structure between remittances and inflation through the evolution dynamics of the two variables of interest; hence the prominence of conducting elaborate techniques.

Figure 1. The evolution of remittances and inflation in Tunisia

4. Empirical results

We first present the results of the time-invariant copula models which are employed as benchmark tests. Then, a time-varying copula model is carried out to evaluate any possible evolutions of the dependence structure between remittances and inflation over time.

4.1. Time-invariant Copulas results

As benchmark testing, we apply various time-invariant copula models to investigate the dependence between inflation and remittances. These copula models include the normal copula, Student-t copula and some variants of the Clayton copula. We summarize the estimates of the parameters of those single-copula models in Table 2. Those estimates are significant for both pairs when the normal, Student- t copula, Clayton (u, v) and Rotated Clayton copula– Clayton ($1-u, 1- v$) are used. However, those estimates appear insignificant for the Rotated Clayton copula (half rotated)- Clayton ($1 - u, v$) and the Rotated Clayton copula (half rotated)-Clayton ($u, 1 - v$). In terms of goodness of fit, the Student-t copula appears the most suited for analysing the focal relationship since it gives the lowest AIC and BIC for both pairs. Based on the Student-t copula, we show that there exists symmetric positive tail dependence between inflation and remittances, implying that increasing remittances induce inflationary pressures in Tunisia. Despite the relevance of these findings, the single copula model ignores the fact that the dependence between inflation and remittances may evolve over different regimes; hence the usefulness of the time-varying copula. With the appearance of extreme events, the assumption of non-normality of the variables become more predominant. Accordingly, copulas are carried out to properly capture the non-normalities of marginal distributions on the one hand, and on the other hand, the asymmetry and the dynamic dependence structure. By carrying out these

techniques, the dependence among the variables under consideration can be captured with more flexibility. These methods are robust to skewness and extreme return clustering. They enable the relationship under study to vary over distinct conditions (low and high uncertainty/volatility). The findings drawn from the time-invariant copula and reported in Table 2 may be irrelevant when it comes to appropriately capturing the dependence among inflation and remittances as it gives an equal weight to the responses to both positive and negative shocks.

Table 2. Estimation of time-invariant copula models

Copulas	Remittances-Inflation	
Normal copula	<i>kappa</i>	0.0654**
	<i>p-value</i>	0.0053
	<i>AIC</i>	-72.4567
	<i>BIC</i>	-68.5321
Student -t copula	<i>kappa</i>	0.0982***
	<i>p-value</i>	0.0000
	<i>AIC</i>	-104.848
	<i>BIC</i>	-98.5203
Clayton (u, v)	<i>kappa</i>	0.1072***
	<i>p-value</i>	0.0000
	<i>AIC</i>	-66.8773
	<i>BIC</i>	-60.5498
Rotated Clayton copula: Clayton (1-u, 1- v)	<i>kappa</i>	0.0987**
	<i>p-value</i>	0.0000
	<i>AIC</i>	-36.7013
	<i>BIC</i>	-30.3738
Rotated Clayton copula (half rotated): Clayton (1 - u, v)	<i>kappa</i>	-0.4231
	<i>p-value</i>	0.667261
	<i>AIC</i>	6.1978
	<i>BIC</i>	9.7632
Rotated Clayton copula (half rotated): Clayton (u, 1 - v)	<i>kappa</i>	0.0652
	<i>p-value</i>	0.69145
	<i>AIC</i>	5.1678
	<i>BIC</i>	7.9435

Note: ***, ** and * imply significance at the 1%, 5% and 10%, respectively.

4.2. Time-varying copula results

Different time-varying copula models are performed to examine whether the dependence between remittances and inflation in Tunisia evolves over time. Table 3 displays the main results. Based on the AIC and BIC information criteria, we clearly show that the time-varying Gaussian copula provides the best fit for the focal link. We show that, for the considered pair, the lower tail dependence parameter (ψ_2) is less pronounced than the upper tail dependence parameter (ψ_1), which means that remittances and inflation are correlated more strongly in high uncertainty regime rather than low uncertainty regime. Summing up, even though the time-invariant copula results (Table 2) reveal that there exist symmetric tail dependences between remittances and inflation, implying that the tail dependences between these variables do not vary by moving from high to low volatility conditions, the time-varying copula findings (Table 3) reveal that the central variables co-move more strongly in high uncertainty circumstances rather than in the low uncertainty scenario. Such analysis underscores the relevance and the effectiveness of accounting for asymmetrical and dynamic tail dependences between remittances and inflation.

Table 3. Parameter estimates of time-varying copulas

Remittances-Inflation	
<i>Time-varying Gaussian copula</i>	
ψ_0	0.0215**
ψ_1	0.0839*
ψ_2	0.0616***
AIC	-183.94
BIC	-167.21
<i>Time-varying Clayton copula</i>	
ψ_0	0.0653***
ψ_1	0.0491**
ψ_2	0.0087**
AIC	-150.182
BIC	-149.016
<i>Time-varying Rotated Clayton copula</i>	
ψ_0	0.04876***

ψ_1	0.0612***
ψ_2	0.0345***
AIC	-99.1479
BIC	-99.1433
<i>Time-varying Student-t copula</i>	
ψ_0	0.001924***
ψ_1	0.041012***
ψ_2	1.972443
N	4.09981**
AIC	-219.395
BIC	-219.388
<i>Time-varying Gumbel copula</i>	
ω_L	-0.07515***
α_L	0.02013***
β_L	0.01587***
AIC	-130.755
BIC	-130.75
<i>Time-varying rotated Gumbel copula</i>	
ω_L	0.0471***
α_L	0.5964
β_L	0.1301***
AIC	-175.833
BIC	-175.829
<i>Time-varying SJC copula</i>	
ω_U	0.0138***
β_U	0.0723**
α_U	0.0587***
ω_L	0.2541
β_L	0.0335***
α_L	0.0229**
AIC	-136.971
BIC	-136.962

Notes: This table displays the estimated dependence parameters of the time-varying Gaussian, Student- t , rotated Gumbel and SJC (Symmetrized Joe Clayton) copulas between inflation and remittances. AIC and BIC represent the values of the Akaike information criterion and the Schwartz information criterion adjusted for small-sample bias. ***, ** and * imply significance at the 1%, 5% and 10%, respectively.

Please note that to ascertain the robustness the aforementioned outcomes, we consider different periods of study, i.e., for the period prior to the COVID-19 (in addition to the period considering the emergence of COVID-19 and the rising political uncertainty). In doing so, our main findings do not change fundamentally. For this reason, they are not reported in the paper, but more details about the obtained findings are available from the authors upon request.

5. Some concluding remarks and policy implications

Inflation is a serious risk especially when it is coupled with an exposure to heightened economic and political uncertainties. Indeed, the level of inflation before the Arab Spring was about 3.52%. This level continued to rise in Tunisia, with the rate being at 3.61% in 2011, and rising to 6.09% in 2020. Such observations require swift actions from governments to deal with this marked increase in inflation. After what opponents considered as “a coup” against the constitution (July 25, 2021), the Tunisian president Kaïs Saïed received the social partners, while attempting to convince them to reduce prices. This initiative has been hailed by many Tunisians, whose purchasing power is eroding under the adverse impact of inflation fluctuating around 6% over the last twelve months. But much more is required to effectively mitigate the inflationary pressures. This would necessitate inter alia an in-depth restructuring of the agricultural system and distribution channels, and dealing with speculation resulting from abuses of certain distributors while manipulating their stocks and creating artificial shortages. **In this study, another inflationary factor is underscored.**

Using several classes of copula models, we find that increasing remittances exert a positive and significant influence on the inflation rate. Moreover, we notice that remittances and inflation are more interdependent in high uncertainty regime rather than low uncertainty state. This means that in times of rising political and economic uncertainty, an increase in remittances would exacerbate inflationary pressures. Remittances are sent to family members and they use them generally in financing basic consumption, health, education and housing. Nevertheless, if remittances are predominantly used for consumption purposes, it may yield to a rise in the domestic demand and if consumption exceeds the domestic production, this will generate a positive output gap then inducing inflation. These considerations highlight the

paramount importance of the Central Bank intervention through a development of appropriate policies that efficaciously counter the impact of remittances on inflation rate by offering attractive investment opportunities and encouraging the recipients of remittances to use them for investment rather than consumption. Tunisia's crisis-stricken economy -hugely in debt, with high inflationary pressures worsened by the COVID-19 crisis- will be a priority for the new government of prime minister-designate Najla Bouden, after a decade of heightened political turmoil that has heavily harmed investments in Tunisia. What is urgently needed today is to pursue proactive measures to encourage economic actors in the country to create wealth and investment.

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Appendix

Figure A1. The impact of COVID-19 on projected inflation in Tunisia in 2020 and 2021

Source: Statista.